

SECRETCHAM-0105
Copy 1 of 5

NEGOTIATED CONTRACT

Contract No. NOas-59-0117
(EE-600)Marquardt Aircraft Company
Van Nuys, California

Contract For: See Schedule

Amount: See Schedule

Mail Invoices to:

Performance Period:
See Schedule

Administrative Data:

This contract is entered into by and between the United States of America, hereinafter called the Government, represented by the Contracting Officer executing this contract, and the above named Contractor which is a corporation, incorporated in the State of California, hereinafter called the Contractor.

The parties hereto agree that the Contractor shall furnish the facilities and deliver all supplies and perform all the services set forth in the attached Schedule issued hereunder, for the consideration stated therein.

The rights and obligations of the parties to this contract shall be subject to and governed by the attached Schedule and General Provisions. In the event of any inconsistency between the Schedule and the General Provisions, the Schedule shall control.

IN WITNESS WHEREOF, the parties hereto have executed this contract as of December 23, 1958.

Signatures:

MARQUARDT AIRCRAFT COMPANY

THE UNITED STATES OF AMERICA

By Roy E. MarquardtBy [Redacted]Roy E. Marquardt
President

Contracting Officer

Title _____

25X1

Orig - EE-600
2 - Contractor
3 - Finance
4 - Cdr Struble
5 - Chrono

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☐ DECLASSIFIED
CLASS. CHANGED TO: TS S 9
NEXT REVIEW DATE: 2011
ADVIS: []
DATE: [] REVIEWER: []

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SCHEDULE

PART I - SCOPE OF WORK

Contractor shall furnish the necessary engineering, design and development to accomplish the work set forth in APPENDIX I attached hereto and made a part of this contract in accordance with Exhibit "A" - TECHNICAL DESCRIPTION - attached hereto and made a part of this contract.

PART II - DELIVERY

The Contractor shall accomplish the work and submit the required reports in accordance with the provisions of APPENDIX I mentioned in PART I hereof.

PART III - ESTIMATED COST AND FIXED FEE

a. The total estimated cost for the performance of this contract, exclusive of the fixed fee, is \$91,511.32.

b. The fixed fee for the performance of this contract is \$6,405.68.

PART IV - PAYMENT

a. In accordance with the provisions of Clause 4 of the General Provisions of this contract entitled, "Allowable Cost, Fixed Fee, and Payment", the Government shall pay the Contractor, as full compensation for the performance of this contract, the fixed fee as specified in PART III above, and the Allowable Cost incurred by the Contractor in the performance of this contract, and accepted by the Contracting Officer as chargeable in accordance with "Contract Cost Principles, Section XV, Part 2, Armed Services Procurement Regulations". It being understood and agreed, without limiting the generality of the foregoing, that the following shall be considered as allowable items of cost incurred hereunder when incurred or paid by the Contractor, and when necessary and required and used for the performance of work hereunder:

- (1) Costs for overtime work shall be an allowable item of cost hereunder only if, and to the extent, that such overtime work has been authorized by the Contracting Officer.
- (2) Travel expense of direct personnel performing liaison with the Bureau of Aeronautics and other sources, as required, to perform the work under Section A, Item 1.
- (3) The amount, if any, determined by the Office of the Comptroller of the Navy (Contract Audit Division) to be allocable to this contract, if any excess of "true depreciation" of facilities acquired under Certificates of Necessity as determined in accordance with Department of Defense Directive 4105.34 dated 1 July 1954, as the same may hereafter be amended, over normal depreciation of such facilities.

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- (4) Costs of development, fabrication, procurement, and/or rental of special test setups, instrumentation, equipment and/or test facility modifications required in connection with the test work performed pursuant to contract requirements whenever such equipment and facilities are not or will not be available at the Government test facilities employed for such work in time to meet the Contractor's working schedule.

b. For purposes of billing current costs incurred under this contract or until such time as an audit of Contractor's interim or final vouchers or invoices is made by the Contracting Officer or his authorized representative, the Contractor shall use the following rates in computing costs incurred hereunder:

"Those rates which are currently approved by the cognizant military department for billing purposes under CPFF contracts."

c. Contractor shall be paid the fixed fee stated in PART III hereof in monthly installments based on allowable costs incurred by the Contractor and approved by the Contracting Officer computed at the same ratio that the total fixed fee stated herein is to the total estimated cost stated herein, subject, however, to the withholding provisions of paragraph (c) of Clause 4 of the General Provisions hereof.

PART V - ANTICIPATORY COSTS

All costs which have been incurred by the Contractor on or after 25 November 1958 in anticipation of and prior to the signing of this contract, and which, if incurred after the signing of this contract, would have been considered as items of Allowable Costs hereunder, will be accepted by the Contracting Officer as costs under this contract.

PART VI - WAIVER OF REQUIREMENTS OF GENERAL PROVISIONS

Notwithstanding the requirements of any of the General Provisions of this contract to the contrary, whensoever the Contractor, in performance of the work under this contract, shall find that the requirements of any of the clauses of the General Provisions are in conflict with security instructions issued to the Contractor by the Contracting Officer or by his duly authorized representative for security matters, the Contractor shall call the attention of the Contracting Officer to such conflict and the Contracting Officer or his duly authorized representative for security matters shall (i) modify or rescind such security requirements or (ii) the Contracting Officer shall issue to the Contractor a waiver of compliance with the requirements of the General Provisions conflicting with such security requirements. Any waiver of compliance with the General Provisions of this contract issued by the Contracting Officer shall be in writing, except that the approval by the Contracting Officer of any subcontract issued hereunder by the Contractor shall be deemed to constitute approval of waiver of any clauses of the General Provisions in conflict with the stipulations of such subcontract.

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(EE-600)**PART VII - SPECIAL SECURITY RESTRICTIONS**

The Contractor shall not reveal (i) the specific nature or any details of the work being performed hereunder or (ii) any information whatsoever with respect to the department of the Government sponsoring this contract and the work thereunder except as the Contractor is directed or permitted to reveal such information by the Contracting Officer or by his duly authorized representative for security matters, and notwithstanding any clause or section of this contract to the contrary, the Contractor shall not interpret any clause or section of this contract as requiring or permitting divulgence of such information to any person, public or private, or to any officer or department of the Government without the express consent of the Contracting Officer or his duly authorized representative for security matters.

PART VIII - AUDIT

Audit of costs hereunder shall be by the cognizant military audit agency, in accordance with security requirements which shall be agreed upon between the Contractor and the Contracting Officer.

PART IX - GOVERNMENT-FURNISHED FACILITIES

The Contractor is hereby authorized to use in the performance of this contract, on a no-charge-for-use basis, the Government-owned facilities provided or scheduled to be provided under Government Facilities Contracts AF 33(038)-5911 and/or AF 33(600)-37639, AF 33(600)-36253, and NO(a)-1135, subject to the terms and conditions of such contracts, provided that such use does not interfere with the performance of the contracts for which the facilities were originally intended. The Contractor's performance shall be contingent upon the use of said facilities. In the event of a delay in providing, or failure to make continuously available said facilities, and upon written request of the Contractor, an equitable adjustment shall be made in the delivery dates and in any other contractual provisions affected thereby, in accordance with the procedures provided for in the clause of this contract entitled "Changes". However, the Government shall not be liable to the Contractor for damage or loss of fee by reason of any delay in providing or failure to provide or continuously make available the said facility.

PART X - GOVERNMENT-FURNISHED TOOLING AND SPECIALIZED TEST EQUIPMENT

In the performance of the work described herein, it is contemplated that the Government shall also make available for use in the performance of this contract, on a no-charge-for-use basis, tooling and specialized testing equipment, in the possession of the Contractor, as fabricated or procured under Government prime or subcontracts, provided that the use of such tooling and equipment does not interfere with the performance of said prime or subcontracts.

PART XI - GOVERNMENT-FURNISHED PROPERTY

Performance of the work called for hereunder is contingent upon the Government supplying certain fuels, hardware, and facility occupancy time, at no cost to the Contractor, as follows:

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(a) Fuels - 150 pounds of pentaborane and 150 pounds of either HEF-2 or H1 Cal 2 shall be furnished with scheduled receipt at the Contractor's plant, Van Nuys, at least two (2) weeks in advance of the scheduled facility occupancy period.

(b) Facility Occupancy - The Government shall make available ~~two~~ ^{three} (3) ~~forty~~ (40) hour occupancy weeks of test time in Cell 2 or 8 of the Air Force-Marquardt Jet Laboratory at Van Nuys, California. It is contemplated that such facility time will be provided by supplement to Facility Operating Contract No. AF 33(600)-35556, in general accordance with Contractor's Proposal No. ~~35556~~ 1614A. *R601*
from

(c) Test Hardware - The Government shall make available for use hereunder one (1) boilerplate ramjet engine, Model XRJ43, as originally constructed under Contract AF 33(600)-34675. Such engine shall be returned to the Government in the state in which it exists at the completion of testing hereunder.

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APPENDIX I

WORK STATEMENT

A. ARTICLES AND SERVICES TO BE FURNISHED

The Contractor shall, for the period of time set forth in (B), Deliveries, hereto, supply the necessary personnel, available facilities, materials and supplies and therewith perform experimental research and shall deliver to the Government the reports as hereafter described.

Item 1 - Experimental Investigations

Experiments shall be conducted by the Contractor which have as their objective the initial documentation of the combustion performance in a ramjet engine of various "special" fuels at combustion pressure levels lower than that considered current "state-of-the-art", and the initial investigations of non-metallics as ramjet engine structural materials.

Specifically, three (3) fuels will be tested: penta-borane, gaseous hydrogen, and HEF-2 or H1 Cal2. Tests will be conducted at selected combustion chamber pressures between the limits of 6 psia to the lowest pressure available in the selected facility, at inlet air temperatures consistent with the pressures. Prime effort shall be directed towards the establishment of the fuel burning limits and combustion efficiency. Data shall also be obtained to reflect the effect of burner length on combustion efficiency level.

Non-metallic structural elements, of a type to be agreed upon with the Contracting Agency, shall be tested as part of the combustion system. Basically, these shall be cylindrical combustion chamber wall sections and a contoured section replacing the engine exit nozzle. Data to be obtained shall be of a gross nature to indicate the usefulness of the material in ramjet structures.

All testing shall be conducted using a ramjet engine which is representative in both size and performance of the current state-of-the-art.

Measurements of the infra-red radiation from the exhaust gases shall be made to establish the level of radiation and a comparison of relative levels between the exhaust gases generated from the fuels tested.

Item 2 - Letter Progress Reports

The Contractor shall prepare and furnish five (5) reproduction copies of each Monthly Letter Progress Report during the performance of work described in Item 1. Each such letter report shall contain a summary of the engineering progress accomplished, the problems encountered during the preceding period, and a brief outline of the work to be performed for the succeeding report period. An approximate rate of expenditure shall be included in each such Letter Progress Report.

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Item 3 - Final Report

The Contractor shall prepare and furnish one (1) reproducible copy and not to exceed thirty (30) copies of a Final Report covering the work performed under Item 1. Such report shall contain a complete description of all work performed thereunder.

B. DELIVERY SCHEDULE

Item 1 - Experimental Investigations

Experimental investigations shall be completed fourteen (14) weeks following receipt of a fully executed contract, or eight (8) weeks after facility occupancy time at MJL-Van Nuys is made available by the Government, and the scheduled receipt of the special fuels to be provided by the Government, whichever is later.

Item 2 - Letter Progress Reports

The copies of the Letter Progress Reports shall be delivered monthly during the program to the Contracting Officer.

Item 3 - Final Report

The copies of the Final Report to be furnished shall be delivered two (2) months following completion of Item 1, Experimental Investigations. Not to exceed twenty-five (25) reproduction copies and one (1) reproducible copy of the Final Report shall be delivered, all transportation charges prepaid to the Contracting Officer by the Bureau of Aeronautics prior to time of delivery.

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EXHIBIT "A"

TECHNICAL DESCRIPTION

I. INTRODUCTION

As a result of studies that have been in progress, sponsored by the Navy, on the feasibility of a ramjet propelled high altitude, long range cruise vehicle, two important factors require further evaluation. The first factor is related to the ramjet engine combustion performance at high altitude; the second is related to enemy detection. This latter factor manifests itself through the problems related to non-metallic engine structural design and through detection of engine exhaust products.

The studies on this cruise vehicle have centered around a flight Mach number of 3 for an altitude ranging from 100,000 to 150,000 feet. Small-scale experimental work that has just been completed indicate that for a Mach number of 3, combustion of pentaborane is possible in a ramjet engine to simulated altitudes of 200,000 feet and combustion of SF-1 is possible to simulated altitudes of 160,000 feet. However, the problem of how complete combustion is for finite burner lengths in the altitude range above 80,000 feet and Mach number of 3 is yet to be resolved.

In the preliminary designs of non-metallic ramjet engines for the cruise application, a realistic, yet optimistic, approach was taken. The designs were realistic in that actual material properties and strength data of available materials were used. In applying this information to detailed preliminary designs, the optimism is related to the fact that no full-scale engine structural shapes have been built and tested for the conditions envisioned in this cruise application, although small-scale sample parts have been evaluated.

Relative to the problem of engine exhaust products detection, no data exist on the extent of infra-red radiation. Although the cruise type ramjet engine will operate at lean fuel-air ratios, and thus relatively low exhaust temperatures, the radiation may be a problem due to a combination of exhaust composition and temperature.

Any experimental data relative to indicating favorable results in the three areas outlined would strengthen the proof of feasibility of the engine preliminary design that has been evolved. It is with this in mind that the following experimental program is being proposed.

II. PLAN OF ATTACK

A. General

In order to get a quick and inexpensive, yet fairly reliable, test performed in the three areas outlined, integrated tests are envisioned utilizing existing test facilities and engine test hardware available at the Marquardt Aircraft Co.

B. Combustion Performance Evaluation

1. Facilities

Cell 8 of the Marquardt Jet Laboratory is being considered for these tests. This cell can operate at cell pressures down to 1.5 psia, with air flows simulating those in a 28-inch diameter ramjet engine. The air temperatures available are sufficient to simulate Mach No. 3.0 flight conditions (approximately 800°R).

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2. Test Setup

The engine test setup will be of the directly-connect inlet type, utilizing existing 28-inch engine boilerplate hardware. All fuel injector flameholder hardware will be directly applicable to the proposed tests since the engine hardware has been developed with HEF-2 fuel. The equipment will be setup to operate with either an unchoked or a choked exhaust, simulating the lowest burner pressures possible in the cell in the range from approximately 1.5 to 6 psia. These conditions will simulate burner operation up to an altitude of 125,000 feet for a Mach number of 3.0.

It is estimated that 150 pounds each of pentaborane and HEF-2 will provide a total of one hour of engine operation. The balance of the testing will be with gaseous hydrogen, which will be readily available.

3. Test Variables

The engine will be setup to test under the most severe combustion conditions possible. Combustion efficiencies of three fuels, pentaborane, HEF-2, and gaseous hydrogen, will be evaluated. The engine tailpipe will be varied from two feet to approximately fifteen feet (if necessary). The fuel-air ratio will be varied within the limits anticipated in flight. Limited variations in air temperature and pressure will be made to evaluate the effect of these upon combustion efficiency.

4. Data Evaluation

The data from these tests will be reduced in terms of flight performance of thrust and SFC. These results will be compared to the predictions of the preliminary design study that has been in progress.

C. Structural Reliability Tests

1. Test Setup

These tests will be run concurrently with those outlined in B. At least one tailpipe and convergent exhaust nozzle will be fabricated of a high temperature non-metallic material such as glass fibers impregnated with a phenolic resin. This structure would be designed similar to a flight type, and would be bolted to the 28-inch diameter boilerplate hardware. The temperature of the non-metallic material would be held at 800°F by means of external water cooling, or varying combustion gas temperatures.

The non-metallic material will be purchased through the Goodyear Aircraft Co., who have been contributing to the engine structural design. In regard to availability of the non-metallic structure, it is anticipated that the fabricated structure will be available in a month to six weeks from work initiation. However, this time is contingent upon raw material availability from the subcontractor.

2. Test Variables

The main test variable will be time of engine operation, in order to test structural reliability. The operating time goal will be at least two hours. If the structure is intact after these tests the material temperature will be increased to 850°F and then 900°F. Since gaseous hydrogen can be used in these tests, the operating time will only be limited by length of cell occupancy time. Thus, at least a total of six hours running time can be obtained.

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3. Test Evaluation

The results of these tests will be evaluated in terms of engine life under flight conditions. These results would be a proof of principle of the engine preliminary design.

D. Infra-red Radiation Tests

With the engine setup in the cell as outlined, instrumentation will be setup and utilized to obtain a relative comparison of the infra-red radiation of the exhaust gases for the three fuels, at several temperature levels for simulated flight conditions. Although tending to be qualitative, these results will still give a measure of the radiation. From this an estimate of the range of the exhaust detection will be made. The infra-red measurements will be made with either a prism or filter type infra-red spectral radiometer.